CLAIMS

1. A steering system for a vehicle, comprising:

a) a steering wheel being positioned for manipulation by a vehicle operator;

b) a steering mechanism for transmitting a steering operation of said steering wheel to vary the angular configuration of a pair of wheels of said vehicle;

c) a power assist mechanism for providing an assisting force to said steering mechanism, said power assist mechanism being activated in response to said steering operation of said steering wheel; and

d) a load displacement system being operatively coupled to said power assist mechanism, said load displacement system allowing transient loads of said steering mechanism to be displaced.

2. A steering system as in claim 1, wherein said power assist mechanism comprises:

i) an electric motor for providing a rotational force to a first motor pulley;

ii) a second motor pulley being fixedly secured to a ball-screw;

iii) a ball-screw nut wherein said ball-screw is configured and dimensioned to meshingly engage said ball-screw nut;

iv) a first universal joint being fixedly attached on one end to a rack housing, and said first universal joint being fixedly attached to said electric motor on its opposing end; and

vi) a second universal joint being fixedly attached to said rack on one end and being fixedly attached to said ball-screw nut on its opposing end.

3. A steering system for a vehicle, comprising:

a) a rack being movably mounted within a rack housing, said rack being coupled to a steerable road wheel at one end and another steerable road wheel at the other end;

b) a ball-screw mechanism being coupled to said rack at one end and an electric motor at the other, said electric motor providing an actuating force to said ball-screw mechanism, said actuating force causing said rack to move linearly within said rack housing;

c) a first coupling mechanism coupling said electric motor to said rack housing; and

d) a second coupling mechanism coupling said ball nut to said rack.

4. The steering system as in claim 3, wherein said first coupling mechanism and said second coupling mechanism are universal joints.

5. The steering system as in claim 4, wherein said actuating force is the rotation of a first pulley fixedly secured to a rotatable shaft of said motor, said first pulley being coupled to a second pulley, said second pulley being fixedly secured to a ball-screw screw of said ball-screw mechanism.

6. The steering system as in claim 5, wherein said first pulley is coupled to said second pulley by a belt.

7. The steering system as in claim 5, wherein the rotation of said ball-screw causes linear movement of a ball-screw nut of said ball-screw mechanism.

8. The steering mechanism as in claim 4, wherein said first and second universal joints each have a gimbal ring with a first pair and a second pair of pins for movably securing said gimbal ring, said first pair of pins being orthogonal with respect to said second pair of pins.

9. The steering mechanism as in claim 5, wherein said first universal joint movably secures said motor and its housing to said rack housing.

10. The steering mechanism as in claim 9, wherein said second universal joint movably secures said ball-screw nut to said rack.

11. The steering mechanism as in claim 7, wherein said ball-screwmechanism further includes a housing, said housing being secured movably secured to said second universal joint.

12. The steering system as in claim 3, further comprising a plurality of sensors for providing signals to a controller, said controller controlling the activation and deactivation of said electric motor.

13. The steering system as in claim 12, wherein said plurality of sensors includes position sensors, force sensors, steering sensors, and a high-resolution sensor.

14. The steering system as in claim 13, wherein said force sensors detect forces acting on the ends of said rack.

15. The steering system as in claim 13, wherein said position sensors detect movements of said rack.

16. The steering system as in claim 13, wherein said steering sensor detects forces applied to a steering wheel.

17. The steering system as in claim 3, wherein said rack includes an anti-rotation mechanism, said anti-rotation mechanism preventing the rotation of said rack.

18. The steering system as in claim 17, wherein said anti-rotation feature includes a plurality of bearings and a protruding member being fixedly secured to said rack, said plurality of bearings movably engaging an elongated opening of said rack housing.

19. A method for providing an actuation force to a rack of a vehicle, comprising:

isolating non-axial loads from an electric motor of a steering system, said motor providing a rotational force to a rotatable member of a rotary-to-linear conversion device; and

isolating non-axial loads from a linearly actuatable member of said rotary-to-linear conversion device, said linearly actuatable member being coupled to a rack of said steering system.

20. A steering system for a vehicle, comprising:

a) a rack being movably mounted within a rack housing, said rack being coupled to a steerable road wheel at one end and another steerable road wheel at the other end;

b) a rotary-to-linear mechanism being coupled to said rack at one end and an electric motor at the other, said electric motor providing an actuating force to said rotary-to-linear mechanism, said actuating force causing said rack to move linearly within said rack housing;

c) a first coupling mechanism coupling said electric motor to said rack housing; and

d) a second coupling mechanism coupling said ball nut to said rack.

21. The steering system as in claim 20, wherein said first coupling mechanism and said second coupling mechanism are universal joints.

22. The steering system as in claim 20, wherein said first coupling mechanism and said second coupling mechanism are compliant members.

23. The steering system as in claim 22, wherein said compliant members are rubber.

24. The steering system as in claim 8, wherein said pins are coated with a rubber material.

25. The steering system as in claim 24, wherein said pins are press fitted in said gimbal rings.

26. The steering system as in claim 3, wherein said steering system is a steer-by-wire system.

27. The steering system as in claim 26, wherein said steer-by-wire system responds to a plurality of inputs from a controller.

28. The steering system as in claim 27, wherein said plurality of inputs indicate movement of a steering mechanism being manipulated by a user.

29. The steering system as in claim 3, wherein said rack is movably mounted a first road wheel and said steering system further comprises:

a second rack being movably mounted within a second rack housing, said second rack being coupled to a second steerable road wheel;

a second ball-screw mechanism being coupled to said second rack at one end and a second electric motor at the other, said second electric motor providing an actuating force to said second ball-screw mechanism, said actuating force causing said second rack to move linearly within said second rack housing;

a first coupling mechanism coupling said second electric motor to said second rack housing; and

a second coupling mechanism coupling said second ball nut to said second rack, wherein said rack and said second rack independently actuate said first road wheel and said second road wheel.

30. The steering system as in claim 3, wherein said electric motor provides a return torque for returning said rack to a center position corresponding to a center position of said road wheels.